Computer Science 360
Midterm Examination
Open Text Book and Notes

Time: 75 minutes
Marks

November 4, 2008

20 1. Provide a very efficient algorithm to solve the following problem. Given a directed graph G, is there a vertex w in G such that from each other vertex v of G there exists a directed path in G from v to w? What is the time complexity of your algorithm?

20 2. You are given an array A of n requests for 2010 olympic tickets. The array is ordered by the time of the request so that $A(1)$ is the first to arrive and $A(2)$ is hthe second to arrive and so on. Each request contains a ten digit telephone number. In order to try to be fair the olympic organizers have made a rule that there can only be one request from each telephone number. It has been noticed that array A contains more than one request from some telephone numbers. Write an $O(n \log n)$ time divide-and-conquer algorithm to remove from A all requests from the same telephone number except the first received. The final ouput should be array A containing $m \leq n$ requests each from a unique telephone number. Also the requests in A should remain in the same order as they were before the duplicates were removed.

20 3. Given two strings $x = x_1x_2 \ldots x_n$ and $y = y_1y_2 \ldots y_m$, provide an $O(nm)$ dynamic programming algorithm that finds the length of their longest common substring.

For example if x = computerscience and y = tersesentence then the longest common substring of x and y is ters of length four.